AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) ~~A Fourier transform processor for processing at least two communication channels, and the Fourier transform processor comprising:~~ An apparatus for processing input sample sets of at least one discrete multi-tone (DMT) modulated communication channel, and the apparatus comprising:

~~a) an input sample delivery circuit configured to deliver the at least two communication channels as a pipelined succession of two-dimensional sample arrays each having dimensions corresponding with communication parameters of the associated one of the at least two communication channels; and~~

- an input memory storing each input sample set as a two-dimensional array of rows and columns of samples;

- an output memory storing two-dimensional arrays of rows and columns of coefficients resulting from a corresponding one of a time-to-frequency domain transformation and a frequency-to-time domain transformation of each input sample set; and

~~b) at least one row and column transform circuit coupled to the input sample delivery circuit to effect a pipelined 2-dimensional Fourier transformation of each successive sample array there from and a length of the pipelined 2-dimensional Fourier transformation dynamically reconfigured for each successive sample array to correspond with the dimensions thereof.~~

- a two-dimensional Fourier transform circuit coupled between the input and output memory to perform the corresponding transformation of the input sample set and having:

- row transform components including a Radix-R butterfly having "R" inputs and "R" output nodes; and the row transform components generating partial row transforms limited to solutions to a single unsolved one of the "R" output nodes of the Radix-R butterfly on each of the "R" iterations through ordered sets of samples from each input sample set; and

- column transform components coupled to the row transform components and configured to generate complete column transforms from the partial row transforms generated by the row transform components prior to a completion of the "R" iterations through each input sample set by the row transform components; thereby to reduce an interval required to transform each successive input sample set.

2. (Cancelled)

3. (Currently Amended) ~~The Fourier transform processor of Claim 1, wherein the input sample delivery circuit and the at least one row and column transform circuit further comprise:~~ The apparatus of Claim 1, wherein the input memory further comprises:

~~device packets encapsulating each sample array and each device packet identifying both the corresponding one of the at least two communication channels together with any processing instructions therefore ; and~~

~~components responsive to each device packet to vary the processing of the associated sample array based on the channel identification and processing instructions in each device packet.~~

- "R" separate memories each storing contiguous blocks of columns of the two-dimensional array or rows and columns of samples of each input sample set, and each of the "R" separate memories coupled to a corresponding one of the "R" inputs of the Radix-R butterfly.

4. (Cancelled)

5. (Currently Amended) ~~The Fourier transform processor of Claim 1, wherein the at least one row and column transform circuit further comprises:~~ The apparatus of Claim 1, wherein further the at least one at least one discrete multi-tone (DMT) modulated communication channel comprises a first DMT communication channel associated communications on a first subscriber line and a second DMT communication channel associated with communications on a second subscriber line, and the first and second DMT communication channels differing from one another in a number of samples per sample set.

~~a sliced radix module of order "R" with R parallel inputs coupled to the input sample delivery circuit and the sliced radix module generating 1/R of the Fourier transforms of each row of each two dimensional sample array on each of R passes through the rows and each of the 1/R Fourier transforms selected to provide a solution of coefficients required to process successive selected ones of the columns of each two dimensional sample array;~~

~~a row module coupled to the sliced radix module to complete each row transform from the sliced radix module; and~~

~~a column module coupled to the row module to complete the Fourier transformation of each successive selected one of the columns of each two dimensional sample array during each of the R passes of the sliced radix module, thereby improving throughput by overlapping row and column processing of each two dimensional sample array.~~

6. (Currently Amended) ~~The Fourier transform processor of Claim 5, wherein the row and column modules each include:~~ The apparatus of Claim 1, wherein the row transform components begin processing the next sample set before the column transform components have completed all the column transforms on a prior sample set.

~~at least one variable order radix sub-module responsive to the input of each sample array to vary an order of the radix based on the dimensions of the sample array.~~

7. (Currently Amended) ~~A Fourier transform processor comprising:~~ The apparatus of Claim 1, wherein the ordered sets of samples processed by the row transform components further comprise samples separated from one another in each row of the input memory by a spacing substantially equal to a number of columns in the input sample array divided by "R".

~~a) an input sample delivery circuit for delivering a sample set of a one of N_f time domain samples and N_f frequency domain samples in a row and column order, and the input sample delivery circuit including;~~

~~logic for determining that the sample set includes frequency domain samples which exhibit hermetian symmetry; and~~

~~logic for limiting the sample set to include only N_f samples by excluding any mirror reversed conjugates there from;~~

~~b) at least one row and column circuit with an input and an output, and the row and column circuit performing a row and column transform on complex valued samples at the input to produce at the output coefficients corresponding with an other of the time domain and the frequency domain; and~~

~~c) at least one sliced radix circuit of order "R" with R parallel inputs coupled to said input sample delivery circuit and an output coupled to the input of said at least one row and column circuit, and said at least one sliced radix circuit transforming N_f/R input samples from the sample set into a selected one among the R possible complex outputs and the deliveries of the sample set to said at least one sliced radix circuit corresponding in a number with the number of remaining ones among the R possible complex outputs.~~

8. (Currently Amended) ~~The Fourier transform processor of Claim 1, wherein the input sample delivery circuit further comprises:~~

~~logic for reducing the dimensions of sample arrays which exhibit hermetian symmetry by excluding any mirror reversed conjugates there from.~~

The apparatus of Claim 1, wherein the row transform components further perform a frequency-to-time domain partial transformation of an input sample set of 4096 samples by generating successive partial solutions in row order to a two-dimensional inverse discrete Fourier transformation (IDFT) identified in the following Equation 1A:

$$x(n_c,n_r)=\frac{1}{4096}\sum_{k_r=0}^{63}\left(\sum_{k_c=0}^{63}X(k_c,k_r)W_{64}^{-n_ck_c}\right)W_{4096}^{-n_ck_r}W_{64}^{-n_rk_r}$$

in which the ordering of the partial row transforms generated by the row transform components on each of "R" iterations through the input sample set corresponds with the processing of each row of the input sample set in accordance with the following Equation 1B:

$$x(n_1,n_2)=\sum_{k_2=0}^{15}\left(\sum_{k_1=0}^{3}X(k_1,k_2)W_4^{-n_1k_1}\right)W_{64}^{-n_1k_2}W_{16}^{-n_2k_2}$$

in which n_1 is fixed at a single value for an iteration through the input sample set and n_2 is varied, and for each subsequent iteration n_1 is incremented to the next value of n_1 and n_2 is varied.

9. (Currently Amended) ~~The Fourier transform processor of Claim 1, wherein the at least one row and column transform circuit further comprises:~~

~~a number "N" sliced radix modules each of order "R" with R parallel inputs coupled to the input sample delivery circuit and the N sliced radix modules each generating 1/R of the transforms on each row on each of R/N passes through the rows of each sample array and each of the 1/R row transforms selected to provide a solution of the coefficients to successive selected ones of the columns;~~

~~row modules each coupled to a corresponding one of the sliced radix modules to complete each row transform from the corresponding one of the sliced radix modules; and~~

~~column modules each coupled to a corresponding one of the row modules and each completing a transformation of each successive selected column during each of the R/N passes of the corresponding one of the sliced radix modules, thereby improving throughput of the at least one row and column transform circuit by overlapping row and column processing.~~

The apparatus of Claim 1, wherein the row transform components further perform a time-to-frequency domain partial transformation of an input sample set of 4096 samples by generating successive partial solutions in row order to a two-dimensional discrete Fourier transformation (DFT) identified in the following Equation 2A :

$$x(k_c,k_r)=\sum_{n_r=0}^{4096}\left(\sum_{n_c=0}X(k_c,k_r)W_{64}^{n_ck_c}\right)W_{64}^{n_rk_c}W_{64}^{n_rk_r}$$

in which the ordering of the partial row transforms generated by the row transform components on each of "R" iterations through the input sample set corresponds with the processing of each row of the input sample set in accordance with the following Equation 2B:

$$x(k_1,k_2)=\sum_{n_2=0}^{15}\left(\sum_{n_1=0}^{3}X(n_1,n_2)W_4^{n_1k_1}\right)W_{64}^{n_2k_1}W_{16}^{n_2k_2}$$

in which n_1 is fixed at a single value for an iteration through the input sample set and n_2 is varied, and for each subsequent iteration n_1 is incremented to the next value of n_1 and n_2 is varied.

10. (Currently Amended) ~~The Fourier transform processor of Claim 9, wherein each of the row and column modules each include:~~

~~at least one variable order radix sub-module responsive to the dimensions of each successive sample array to vary an order of the radix correspondingly.~~

The apparatus of Claim 1, wherein the two-dimensional Fourier transform circuit further reduces the interval required to perform a frequency-to-time domain transformation of an input sample set which exhibits hermetian symmetry by avoiding partial row transforms of approximately half the rows which are mirror reversed conjugates, and in which further the column transform components further provide a conjugation operation to expand the number of rows output to the output memory to correspond with the number of rows in the input sample set.

11. (Canceled)

12. (Currently Amended) ~~A method for computing Fourier transforms of at least two communication channels, and the method comprising:~~

~~delivering the at least two communication channels as a pipelined succession of two dimensional sample arrays each having dimensions corresponding with communication parameters of the associated one of the at least two communication channels; and~~

~~dynamically re-configuring a length of a pipelined 2-dimensional Fourier transformation of each successive sample array delivered in the delivering act to correspond with the dimensions of each successive sample array.~~

A method for processing input sample sets of at least one discrete multi-tone (DMT) modulated communication channel, and the method comprising:

- storing each input sample set as a two-dimensional array of rows and columns of samples;
- generating partial row transforms limited to solutions to a single unsolved one of the "R" output nodes of the Radix-R butterfly on each of "R" iterations through ordered sets of samples from each input sample set stored in the storing act; and
- generating complete column transforms from the partial row transforms generated in the first generating act prior to a completion of the "R" iterations through each input sample set in the first generating act; thereby to reduce an interval required to transform each successive input sample set from a corresponding one of a time-to-frequency domain and a frequency-to-time domain.

13. (Cancelled)

14. (Currently Amended) The method of Claim ~~13~~ 12, wherein the ~~delivering act communication parameters include a number of tones of a corresponding multi-tone communication protocol and wherein further the number of tones exhibited by a first of the at least two communication channels differs from the number of tones exhibited by a second of the at least two communication channels.~~ storing act further comprises:

- storing contiguous blocks of columns of the two-dimensional array or rows and columns of samples of each input sample set, in each of "R" separate memories coupled to a corresponding one of the "R" inputs of the Radix-R butterfly.

15. (Cancelled)

16. (Currently Amended) The method of Claim 12, wherein ~~the delivering act further comprises:~~

~~reducing the dimensions of sample arrays which exhibit Hermetian symmetry by excluding any mirror reversed conjugates there from.~~

further the at least one discrete multi-tone (DMT) modulated communication channel comprises a first DMT communication channel associated communications on a first subscriber line and a second DMT communication channel associated with communications on a second subscriber line, and the first and second DMT communication channels differing from one another in a number of samples per sample set.

17. (Currently Amended) ~~A method of computing a two-dimensional Fourier transform, and the method comprising the acts of:~~

~~selecting a sample set of N_f samples corresponding with a one of a frequency domain and a time domain;~~

~~determining that the sample set includes frequency domain samples which exhibit hermetian symmetry; and~~

~~limiting the sample set to include only N_f samples by excluding any mirror reversed conjugates there from.~~

~~generating sliced radix transforms of an order R for each of N_f/ R selected subsets of the sample set, with each subset including R samples and with a slice corresponding with a radix R transformation of the R inputs from each of the selected subsets to a selected one among R complex outputs;~~

~~completing row and column transforms on the complex outputs generated in said act of generating; and~~

~~repeating the generating and completing acts for each of a remaining ones of the R complex outputs, to transform the N_f samples of the sample set to the other of the frequency domain and the time domain.~~

The method of Claim 12, wherein the first generating act further comprises:

beginning processing a next sample set before generating in second generating act an entire set of column transforms on a prior sample set.

18. (Currently Amended) ~~The method of Claim 12, wherein the dynamically varying act further comprises:~~

~~generating 1/R of the radix order "R" Fourier transforms on each row of each two dimensional sample array on each of R passes through the rows and each of the 1/R Fourier transforms selected to provide a solution of coefficients required to process successive selected ones of the columns of each two dimensional array;~~

~~completing each row transform generated in the generating act; and~~

~~effecting a transformation of each successive selected ones of the columns during each of the R passes in the generating act, thereby improving throughput by overlapping row and column processing of each two dimensional sample array.~~

The method of Claim 12, wherein the ordered sets of samples processed in the first generating act further comprise samples separated from one another in each row of the input memory by a spacing substantially equal to a number of columns in the input sample array divided by "R".

19. (Currently Amended) ~~The method of Claim 18, wherein the completing and effecting acts further comprise:~~

~~varying an order of a radix transform of each successive sample array based on the dimensions of the sample array.~~

The method of Claim 12, wherein the partial row transforms in the first generating act for a frequency-to-time domain transformation of an input sample set of 4096 samples

conform with successive partial solutions in row order to a two-dimensional inverse discrete Fourier transformation (IDFT) identified in the following Equation 1A :

$$x(n_c,n_r)=\frac{1}{4096}\sum_{k_r=0}^{63}\left(\sum_{k_c=0}^{63}X(k_c,k_r)W_{64}^{-n_ck_c}\right)W_{4096}^{-n_ck_r}W_{64}^{-n_rk_r}$$

in which the ordering of the partial row transforms generated by the first generating act on each of "R" iterations through the input sample set corresponds with the processing of each row of the input sample set in accordance with the following Equation 1B:

$$x(n_1,n_2)=\sum_{k_2=0}^{15}\left(\sum_{k_1=0}^{3}X(k_1,k_2)W_4^{-n_1k_1}\right)W_{64}^{-n_1k_2}W_{16}^{-n_2k_2}$$

in which n_1 is fixed at a single value for an iteration through the input sample set and n_2 is varied, and for each subsequent iteration n_1 is incremented to the next value of n_1 and n_2 is varied.

20-21. (Canceled)

22. (New) The method of Claim 12, wherein the first generating act further comprises performing a time-to-frequency domain partial transformation of an input sample set of 4096 samples by generating successive partial solutions in row order to a two-dimensional discrete Fourier transformation (DFT) identified in the following Equation 2A :

$$x(k_c,k_r)=\sum_{n_r=0}^{4096}\left(\sum_{n_c=0} X(k_c,k_r)W_{64}^{n_c k_c}\right)W_{64}^{n_r k_c}W_{64}^{n_r k_r}$$

in which the ordering of the partial row transforms generated in the first generating act on each of "R" iterations through the input sample set corresponds with the processing of each row of the input sample set in accordance with the following Equation 2B:

$$x(k_1,k_2)=\sum_{n_2=0}^{15}\left(\sum_{n_1=0}^{3} X(n_1,n_2)W_4^{n_1 k_1}\right)W_{64}^{n_2 k_1}W_{16}^{n_2 k_2}$$

in which n_1 is fixed at a single value for an iteration through the input sample set, and n_2 is varied and for each subsequent iteration n_1 is incremented to the next value of n_1 and n_2 is varied.

23. (New) The method of Claim 12, wherein the first and second generating acts further comprise:

- limiting partial row transforms in the first generating act, on an input sample set which exhibits hermetian symmetry, to approximately half the rows by avoiding partial row transforms of rows which are mirror reversed conjugates; and
- providing in the second generating act a conjugation operation to expand a number of rows output to correspond with the number of rows in the input sample set, thereby further reducing the interval required to transform each successive input sample set from the frequency domain to the time domain.